

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application:

1. (currently amended) A light-emitting device comprising:

a compound semiconductor layer having a light-emitting layer portion, being configured so that one main surface of which serves as a light extraction surface;

wherein the light-emitting layer portion is configured as having a double heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order;

a device substrate bonded on the other main surface side of the compound semiconductor layer;

and an Ag-base metal layer interposed between the device substrate and the compound semiconductor layer, including an Ag-base reflective metal layer having Ag as a major component over the entire portion thereof, and being intended for reflecting the light from the light-emitting layer portion back towards the light extraction surface side;

wherein, the light-emitting device, further comprising a light-emitting-layer portion-side, Ag-base contact layer having Ag as a major component, which is arranged in a discrete manner on the main surface of the Ag-base reflective metal layer, between

the Ag-base reflective metal layer and the compound semiconductor layer.

2. (original) The light-emitting device as claimed in Claim 1, wherein the light-emitting layer portion has a peak emission wavelength within a range from 350 nm to 670 nm, both ends inclusive.

3 - 4. (cancel)

5. (previously presented) The light-emitting device as claimed in Claim 1, wherein the light-emitting-layer-portion-side, Ag-base contact layer is an AgGeNi contact layer.

6. (previously presented) The light-emitting device as claimed in Claim 1, wherein the ratio of formation area of the light-emitting-layer-portion-side, Ag-base contact layer to the Ag-base reflective metal layer falls within a range from 1% to 25%, both ends inclusive.

7. (previously presented) The light-emitting device as claimed in Claim 1, wherein the Ag-base reflective metal layer has a ratio of Ag content which is set higher than that of the light-emitting-layer-portion-side, Ag-base contact layer.

8. (original) The light-emitting device as claimed in Claim 1, wherein the Ag-base

reflective metal layer has a ratio of Ag content of 95% by mass or above.

9. (original) The light-emitting device as claimed in Claim 8, wherein the Ag-base reflective metal layer is composed of pure Ag.

10. (currently amended) A light-emitting device as claimed in claim 1, comprising:

a compound semiconductor layer having a light-emitting layer portion, being configured so that one main surface of which serves as a light extraction surface;

a device substrate bonded on the other main surface side of the compound semiconductor layer;

and an Ag-base metal layer interposed between the device substrate and the compound semiconductor layer, including an Ag-base reflective metal layer having Ag as a major component over the entire portion thereof, and being intended for reflecting the light from the light-emitting layer portion back towards the light extraction surface side wherein, the Ag-base reflective layer of the light-emitting device is composed of a Pd-containing Ag alloy.

11. (currently amended) A light-emitting device comprising:

a compound semiconductor layer having a light-emitting layer portion, being configured so that one main surface of which serves as a light extraction surface;

wherein the light-emitting layer portion is configured as having a double

heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order:

a device substrate bonded on the other main surface side of the compound semiconductor layer;

and an Ag-base metal layer interposed between the device substrate and the compound semiconductor layer, including an Ag-base reflective metal layer having Ag as a major component over the entire portion thereof, and being intended for reflecting the light from the light-emitting layer portion back towards the light extraction surfaced side wherein, the device substrate of the light-emitting is a conductive semiconductor substrate, and the device further comprises a substrate-side, Ag-base contact layer which is formed between the device substrate and the Ag-base reflective metal layer, and has Ag as a major component.

12. (original) The light-emitting device as claimed in Claim 11, wherein the device substrate is a Si substrate.

13. (original) The light-emitting device as claimed in Claim 11, wherein the substrate-side, Ag-base contact layer is an AgSb contact layer or an AgSn contact layer.

14 – 20. (cancel)

21. (currently amended) A light-emitting device comprising:

a light-emitting layer portion being composed of a first compound semiconductor, having an emission peak wavelength of 450 to 580 nm, and having a light extraction surface on the main surface side thereof;

wherein the light-emitting layer portion is configured as having a double heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order;

an Ag-base contact layer formed on the main back surface of the light-emitting layer portion, or formed on the main back surface of an auxiliary compound semiconductor layer composed of a second compound semiconductor, which is transparent with respect to emission light flux and is electrically coupled to the main back surface of the light-emitting layer portion, the Ag-base contact layer comprising an alloyed layer originated from an Ag-base contact metal, having Ag as a major component, and the compound semiconductor composing the main back surface of the compound semiconductor layer; and

an Ag-base reflective metal layer, composed of a metal having Ag as a major component, for reflecting light from the light-emitting layer portion back towards the light extraction surface side, and being formed so as to cover the Ag-base contact layer.

22. (cancel)

23. (original) The light-emitting device as claimed in Claim 21, wherein the auxiliary compound semiconductor layer is a transparent conductive substrate bonded to a compound semiconductor layer composing the light-emitting layer portion, and the Ag-base reflective metal layer reflects light from the light-emitting layer portion back towards the light extraction surface side through the transparent conductive substrate.

24. (original) The light-emitting device as claimed in Claim 23, wherein the Ag-base contact layer is arranged in a discrete manner on the main surface of the Ag-base reflective metal layer, between the Ag-base reflective metal layer and the transparent conductive substrate.

25. (original) The light-emitting device as claimed in Claim 24, wherein the Ag-base contact layer is formed in a ratio of formation area of 1% to 25%, both ends inclusive, with respect to the Ag-base reflective metal layer.

26. (original) The light-emitting device as claimed in Claim 21, wherein the Ag-base reflective metal layer has a ratio of Ag content larger than that of the Ag-base contact layer.

27. (original) The light-emitting device as claimed in Claim 21, wherein the Ag-base reflective metal layer has a ratio of Ag content of 95% by mass or above.

28. (original) The light-emitting device as claimed in Claim 27, wherein the Ag-base reflective metal layer is composed of pure Ag.

29. (original) The light-emitting device as claimed in Claim 21, wherein the Ag-base reflective metal layer is composed of a Pd-containing Ag alloy.

30. (original) An ohmic electrode structure for a semiconductor device comprising;

an Ag-base contact layer formed on the surface of a device main body composed of a Group III-V compound semiconductor, and comprising an alloyed layer originated from an AgGeNi contact metal having Ag as a major component and including also Ni and Ge, and the Group III-V compound semiconductor; and

an electrode layer formed so as to cover the Ag-base contact layer, and being composed of an Ag-base metal having Ag as a major component.

31. (currently amended) A light-emitting device comprising:

a compound semiconductor layer having a light-emitting layer portion, being configured so that a first main surface of which serves as a light extraction surface;

wherein the light-emitting layer portion is configured as having a double heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order; and

a device substrate bonded on a second main surface side of the compound semiconductor layer while placing a main metal layer in between, the main metal layer having a reflective surface for reflecting light from the light-emitting layer portion back towards the light extraction surface side; further comprising:

a diffusion-blocking layer interposed between the device substrate and the main metal layer, being composed of a conductive material, and provided for blocking diffusion of any device-substrate-derived components towards the main metal layer;

further comprising a substrate-side contact metal layer interposed between the diffusion-blocking layer and the device substrate, intended for reducing contact resistance between the device substrate and the diffusion-blocking layer.

32. (cancel)

33. (original) The light-emitting device as claimed in Claim 31, wherein the main metal layer is composed of an Au-base layer having Au as a major component, at least in a portion including the interface with the diffusion-blocking layer, and the device substrate is a Si substrate.

34. (original) The light-emitting device as claimed in Claim 33, wherein the diffusion-blocking layer is a metal layer for blocking diffusion, having either Ti or Ni as a major component.

35. (original) The light-emitting device as claimed in Claim 34, wherein the metal layer for blocking diffusion has a thickness of 1 nm to 10 μm , both ends inclusive.

36. (original) The light-emitting device as claimed in Claim 33, wherein the device substrate is an n-type Si substrate, and further comprises a substrate-side contact metal layer interposed between the diffusion-blocking layer and the Si substrate, being composed of an AuSb alloy or an AuSn alloy, and being intended for reducing contact resistance between the Si substrate and the diffusion-blocking layer.

37. (original) The light-emitting device as claimed in Claim 33, wherein the Au-base layer composes the reflective layer.

38. (currently amended) A light-emitting device comprising:
a compound semiconductor layer having a light-emitting layer portion, being configured so that a first main surface of which serves as a light extraction surface;
wherein the light-emitting layer portion is configured as having a double heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})_y\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order; and

a device substrate bonded on a second main surface side of the compound semiconductor layer while placing a main metal layer in between, the main metal layer having a reflective surface for reflecting light from the light-emitting layer portion back

towards the light extraction surface side; further comprising;

a diffusion-blocking layer interposed between the device substrate and the main metal layer, being composed of a conductive material, and provided for blocking diffusion of any device-substrate-derived components towards the main metal layer;

wherein, the main metal layer is composed of an Au-base layer ~~having Au as a major component, composed of pure Au, or an Au alloy having a ratio of Au content ratio of 95% by mass or above,~~ at least in a portion including the interface with the diffusion-blocking layer, and the device substrate in a Si substrate; and

wherein the Ag-base layer interposed between the Au-base layer and the compound semiconductor layer, and having Ag as a major component, composes the reflective layer.

39 – 48. (cancel)

49. (currently amended) A light-emitting device comprising:

a compound semiconductor layer having a light-emitting layer portion, being configured so that one main surface of which serves as a light extraction surface;

wherein the light-emitting layer portion is configured as having a double heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order;

a device substrate bonded on the other main surface side of the light-emitting

layer portion;

and a reflective metal layer interposed between the device substrate and the light-emitting layer portion, having any one of Ru, Rh, Re, Os, Ir and Pt as a major component, and being intended for reflecting the light from the light-emitting layer portion back towards the light extraction surface side.

50. (original) The light-emitting device as claimed in Claim 49, wherein the light-emitting layer portion has a peak emission wavelength of 670 nm or shorter.

51 – 62. (cancel)

63. (currently amended) A compound semiconductor layer having a light-emitting layer portion being configured so that one main surface of which serves as a light extraction surface;

wherein the light-emitting layer portion is configured as having a double heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order;

a device substrate bonded on the other main surface side of the light-emitting layer portion; and

a reflective metal layer interposed between the device substrate and the light-emitting layer portion having Ag as a major component, and being intended for

reflecting the light from the light-emitting layer portion back towards the light extraction surface side;

wherein the Ag base reflective metal layer is bonded to the light-emitting layer portion while placing a protective metal layer which contains Au, Ru, Rh, Os, Ir or Pt as, a major component, in contact with the Ag-base reflective metal layer in between.

64. (original) The light-emitting device as claimed in Claim 63, wherein the protective metal layer is an Au-base metal layer having Au as a major component.

65. (original) The light-emitting device as claimed in Claim 63, wherein the protective metal layer has a thickness of 0.5 nm to 15 nm, both ends inclusive.

66. (currently amended) A light-emitting device comprising:
a compound semiconductor layer having a light-emitting layer portion, being configured so that one main surface of which serves as a light extraction surface;
wherein the light-emitting layer portion is configured as having a double heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order;

a device substrate bonded on the other main surface side of the light-emitting layer portion;

and a reflective metal layer interposed between the device substrate and the

light-emitting layer portion, having any one of Ag, Ru, Rh, Re, Os, Ir and Pt as a major component, and being intended for reflecting the light from the light-emitting layer portion back towards the light extraction surface side;

wherein the reflective metal layer is bonded to the device substrate while placing a binding-use metal layer in between; and

wherein the binding-use metal layer is an Au-base metal layer ~~having Au as a major component~~ composed of pure Au, or an Au alloy having a ratio of Au content ratio of 95% by mass or above.

67. (cancel)

68. (previously presented) The light-emitting device as claimed in Claim 66, wherein the reflective metal layer is bound to the device substrate while placing the binding-use metal layer which is composed of a first Au-base layer and a second Au-base layer disposed in contact with each other in this order as viewed from the reflective metal layer side.

69 – 80. (cancel)

81. (currently amended) A light-emitting device comprising:

a compound semiconductor layer having a light-emitting layer portion, being configured so that a first main surface of which serves as a light extraction surface;

wherein the light-emitting layer portion is configured as having a double heterostructure in which a first-conductivity-type cladding layer, an active layer and a second-conductivity-type cladding layer, all of these layers being composed of $(\text{Al}_x\text{Ga}_{1-x})\text{In}_{1-y}\text{P}$ (where, $0 \leq x \leq 1$ and $1 \leq y \leq 1$), are stacked in this order;

a Si substrate bonded on a second main surface side of the compound semiconductor layer while placing a metal layer in between;

wherein the bonding surface of the metal layer with the compound semiconductor layer forms a reflective layer, and the metal layer has a Si-diffusion-blocking layer having Au or Ag as a major component and also containing a Si-diffusion-blocking component which comprises a single, or two or more elements selected from Sn, Pb, In and Ga, and being planned for inhibiting Si diffused from the Si substrate from depositing on the reflective surface.

82. (original) The light-emitting device as claimed in Claim 81, wherein the Si-diffusion-blocking layer has a content of the Si-diffusion-blocking component of 1% by mass to 20% by mass, both ends inclusive.

83. (original) The light-emitting device as claimed in Claim 81, further comprising a substrate-side contact alloyed layer interposed between the Si-diffusion-blocking layer and the Si substrate, and being intended for reducing contact resistance between the Si substrate and the Si-diffusion-blocking layer.

84. (original) The light-emitting device as claimed in Claim 81, wherein the metal layer has a main metal layer between the compound semiconductor layer and the Si-diffusion-blocking layer, the main metal layer having a content of the Si-diffusion-blocking component smaller than that of the Si-diffusion-blocking layer.

85. (original) The light-emitting device as claimed in Claim 84, wherein the Si-diffusion blocking layer has a thickness of 50 nm or above and 5 μm or less.

86. (original) The light-emitting device as claimed in Claim 84, wherein
the Si-diffusion-blocking layer has Au as a major component; and
the main metal layer comprises an Au-base main metal layer which forms the reflective surface and has Au as a major component.

87. (original) The light-emitting device as claimed in Claim 84, wherein
the Si-diffusion-blocking layer has Au as a major component; and
the main metal layer is composed of an Au-base coupling layer having Au as a major component, in a portion thereof in contact with the Si-diffusion-blocking layer, and is composed of an Ag-base reflective layer having Ag as a major component or an Al-base reflective layer having Al as a major component, in a portion thereof composing the reflective surface.

88. (original) The light-emitting device as claimed in Claim 81, wherein the

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reflective surface is configured by the Si-diffusion-blocking layer.

89 – 90. (cancel)